HEATHKIT® MANUAL

METER GROUP FILE

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HEA TON HARBOR, MICHIGAN

YOUR HEATHKIT 90 DAY LIMITED WARRANTY

If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY
BENTON HARBOR, MI. 49022

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information	(616) 982-3411
Credit	(616) 982-3561
Replacement Parts	(616) 982-3571

Technical Assistance Phone Numbers

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

R/C, Audio, and Electronic Organs	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Weather Instruments and Home Clocks	(616) 982-3315
Television	(616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive, Appliances and General Products	(616) 982-3496
Computers	(616) 982-3309

Prices and specifications subject to change without notice.

Heathkit® Manual

for the

DECADE CAPACITANCE KIT

Model IN-3127

595-1966

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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TABLE OF CONTENTS

Introduction 2

Parts List 3

Assembly notes 5

Step-by-Step Assembly 6

Operation 13

In Case Of Difficulty 13

Specifications 14

Circuit Description 15

Schematic ..... Fold-in

Warranty ..... Inside front cover

Customer Service ..... Inside rear cover

INTRODUCTION

The Decade Capacitance Kit is designed for use as an accurate laboratory-type instrument where a wide-range, variable capacitor is necessary. A few of its many uses include substitution for: tuned circuit elements, bridge impedances, and filter elements. For speed and convenience, it is often more desirable to use the Decade Capacitance Kit to determine circuit capacitive values and, therefore, avoid involved calculations. The Heathkit Decade Resistance Kit makes an ideal companion with the Decade Capacitance Kit when solving resistance and capacitance circuits where a large range of values is necessary.

Refer to the "Kit Builders Guide" for information on unpacking, parts identification, tools, wiring, and soldering.

PARTS LIST

Check each part against the following list. Make a check (✓) as you identify each part. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not discard any packing materials until all parts are accounted for.

Each circuit part in this kit has its own "Circuit Component Number" (R1, C11, D21, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of the Manual. These numbers will appear:

- In the Parts List.
- At the beginning of each step where a component is installed.
- In some illustrations.
- In the sections at the rear of the Manual.
- In the Illustration Booklet.
- Schematic.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
NOTE: The capacitor sizes may vary.				
Mica				
A1	20-148	1	100 pF, 500 V	C3
A1	20-165	1	200 pF, 500 V	C4
A1	20-712	1	300 pF, 500 V	C1
A1	20-713	1	400 pF, 500 V	C2
Mylar*				
A2	27-205	1	.01 μF, 400 V	C11
A2	27-198	1	.02 μF, 400 V	C12
A2	27-199	1	.03 μF, 400 V	C9
A2	27-200	1	.04 μF, 400 V	C10

*DuPont Registered Trademark

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Polystyrene				
A3	29-50	1	1000 pF, 630 V	C7
A3	29-51	1	2000 pF, 630 V	C8
A3	29-52	1	3000 pF, 630 V	C5
A3	29-53	1	4000 pF, 630 V	C6
SHEET METAL PARTS				
	90-351-3	1	Cabinet shell	
	203-1862-1	1	Front panel	

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
HARDWARE				
B1	250-8	4	#6 × 3/8"sheet metal screw	
B2	250-89	2	6-32 × 3/8" screw	
B3	252-3	4	6-32 nut	
B4	252-7	3	Control nut	
B5	252-22	2	#6 Speed Nut**	
B6	253-10	3	Control flat washer	
B7	254-4	3	Control lockwasher	
B8	259-1	2	#6 solder lug	

** Registered Trademark, Tinnerman Co.

MISCELLANEOUS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
C1	63-449	3	Range switch	
C2	100-16-2	1	Black binding post cap	
C2	100-16-18	1	Red binding post cap	
C3	427-3	2	Binding post base	
C4	75-17	4	Binding post insulator	
C5	261-49	4	Rubber foot	
	340-3	2′	Wire	
C6	462-999	3	Knob	
C7	455-619	3	Knob bushing	

PRINTED MATERIAL

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
E1	391-34	1	Blue and white label	
	597-260	1	Parts Order Form	
	597-308	1	Kit Builders Guide	
		1	Manual (See front cover for part number.)	
			Solder	

ASSEMBLY NOTES

1. Before you start to assemble this kit, review the wiring and soldering information in the "Kit Builders Guide." Also be sure to read each step all the way through before you perform that step.

2. Capacitors will be called out by their capacitance value (in pF or μF) and type (mica, Mylar, or polystyrene).

3. The illustrations in this Manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to clearly show all of the parts.

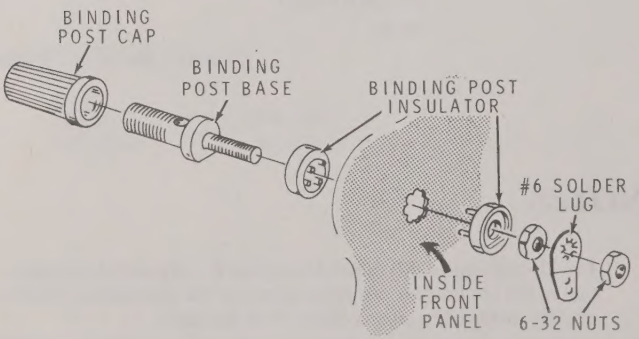
SAFETY WARNING: Avoid eye injury when you cut off excess leads. Hold the leads so they cannot fly toward your eyes.

STEP-BY-STEP-ASSEMBLY

Refer to Pictorial 1 (Illustration Booklet, Page 2) for the following steps.

NOTE: Place a cloth on your work surface to prevent the front panel from becoming scratched during the assembly.

(X) Position the front panel as shown.



Detail 1A

( ) Refer to Detail 1A and install the black binding post assembly at hole A as follows:

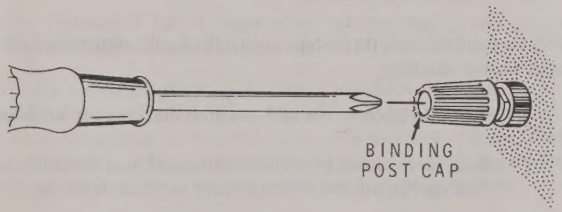
1. Press a binding post insulator into the hole from each side of the front panel. (The flat on the outside insulator should be parallel with the bottom edge of the front panel.)

2. Insert the binding post base into the two insulators from the front and secure the assembly with a 6-32 nut. Make sure the flat of the binding post base corresponds with the flat in the binding post insulator.

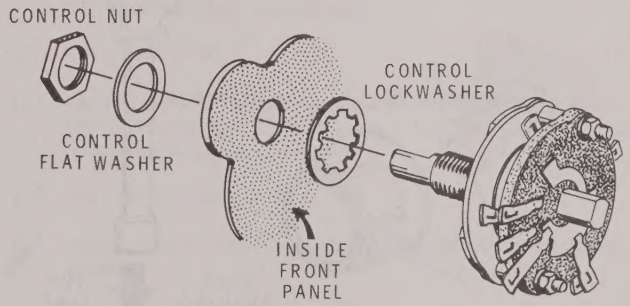
3. Place a #6 solder lug over the small threads on the binding post base. Then secure the solder lug with a 6-32 nut. NOTE: Position the #6 solder lug toward the bottom edge of the front panel.

4. Screw the black binding post cap onto binding post base A.

( ) Similarly, install a red binding post assembly at hole B.



Detail 1B

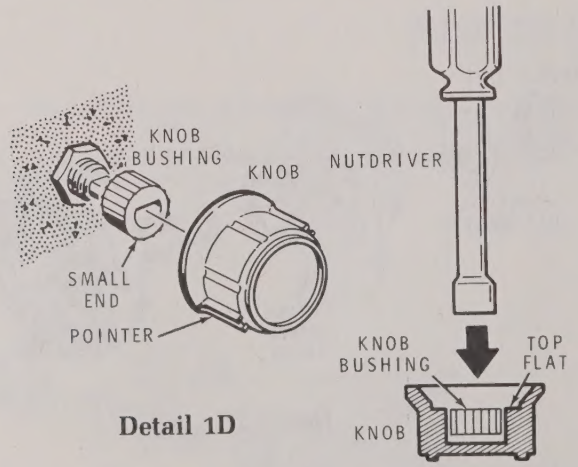


Detail 1C

( ) Refer to Detail 1B and slightly spread the open end of the binding posts with a phillips screwdriver after the binding post caps have been screwed on. Tap the screwdriver lightly. This will keep the binding post caps from falling off.

( ) Refer to Detail 1C and mount one of the range switches at hole C with a control lockwasher, a control flat washer, and control nut. Position the lugs as shown in the Pictorial.

( ) Similarly, mount the two remaining range switches at holes D and E. Position the lugs as shown.



Detail 1D

Refer to Detail 1D and notice that the knob bushing is tapered slightly. Make sure, in the next step, to place this bushing on the shaft with the small end facing out, or the knob will not slide onto it. (Roll the bushing on a flat surface if you are unsure about it; the bushing will gradually turn toward the small end.)

( ) Push a knob bushing part way onto each of the three switch shafts. Then turn all the switch shafts to their full counterclockwise position.

( ) Refer to Detail 1D and at one of the switch locations, line up the pointer of a knob with the "0" (zero) marking on the front panel. Press the knob part way onto the knob bushing. Rotate the knob clockwise to each of the switch stop positions and make sure the pointer lines up with each front panel mark.

NOTE: Perform the next three steps only if the knob pointer does **not** line up at each switch marking.

1. ( ) Turn the knob to the mid-position marking on the front panel.

2. ( ) Remove the knob from the bushing and turn the knob slightly to line up the pointer with the mid position marking.

3. ( ) Press the knob part way onto the knob bushing and recheck the pointer alignment. If more than a slight error is noticed at either end position, repeat these three steps.

( ) Carefully remove the knob bushing and knob together from the shaft.

( ) Refer to Detail 1D and place the knob on a table or other hard surface. Drive the knob bushing into the knob until it is flush with the top flat of the knob.

( ) Press the knob and bushing firmly onto the switch shaft.

( ) Similarly, install the remaining two knobs and knob bushings on the remaining switch shafts.

Refer to Pictorial 1 (Illustration Booklet, Page 2) for the proper wire positioning in the following steps.

( ) Cut a 7" wire.

( ) Refer to Detail 1E Part A (Illustration Booklet, Page 2) and shape a 7" wire to the dimensions shown.

NOTE: In the following steps, (S-1) means to solder the connection. Use special care when you solder these connections. Apply enough heat and solder to the connection so the wire is properly soldered. Where there are two lugs at a switch position, regard both lugs as one. Push the end of the wire through both switch lugs and solder the wire to both lugs.

( ) Connect the 7" wire between switch C lug 9 (S-1) and switch E lug 9 (S-1). Make sure the double lugs are soldered. Form this wire as shown in the inset drawing. The wire should not touch any of the other switch lugs.

( ) Cut a 1-1/2" wire.

( ) Connect the 1-1/2" wire between switch D lug 9 (S-1) and the middle of the 7" wire (S-1). Crimp one end of the 1-1/2" wire around the 7" wire and then insert the other end into the double switch lugs. Make sure the double lugs are soldered.

( ) Cut a 1-1/4" wire.

( ) Connect the 1-1/4" wire between the solder lug of binding post B (S-1) and the 7" wire (S-1). Crimp the end of the 1-1/4" wire around the 7" wire as in the previous step.

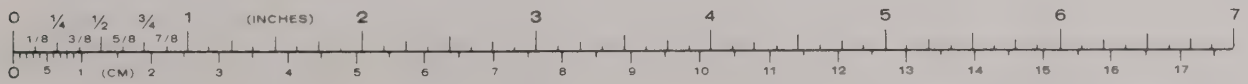
( ) Cut a 6-5/8" wire.

( ) Refer to Detail 1E Part B and shape the 6-5/8" wire to the dimensions shown.

( ) Connect the 6-5/8" wire between switch C lug 11 (S-1) and switch E lug 2 (S-1). Do not insert more than 1/8" of the wire end through the switch lug. Position this wire as shown in the inset drawing.

( ) Cut a 2-1/4" wire.

( ) Connect the 2-1/4" wire between the solder lug of binding post A (S-1) and the 6-5/8" wire (S-1) as shown. Crimp the end of the wire around the connection.



Refer to Pictorial 2 (Illustration Booklet, Page 3) for the following steps.

NOTE: When you connect the capacitors in the following steps, position them so they are parallel to each other as shown in the Pictorial.

Connect one lead of the following capacitors to the indicated switch lug and the other lead to the 6-5/8" wire. Wrap each capacitor lead around the wire, then solder the connection and cut off the excess lead length.

	VALUE	SWITCH C, LUG
( )	C4: 200 pF mica	5 (double lug)
( )	C3: 100 pF mica	6
( )	C2: 400 pF mica	7
( )	C1: 300 pF mica	8

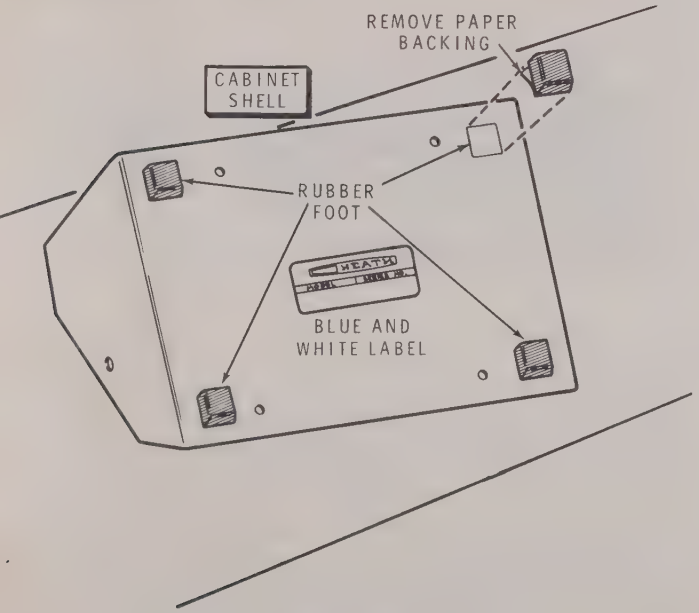
	VALUE	SWITCH D, LUG
( )	C8: 2000 pF polystyrene	5 (double lug)
( )	C7: 1000 pF polystyrene	6
( )	C6: 4000 pF polystyrene	7
( )	C5: 3000 pF polystyrene	8

	VALUE	SWITCH E, LUG
( )	C12: .02 μF Mylar	5 (double lug)
( )	C11: .01 μF Mylar	6
( )	C10: .04 μF Mylar	7
( )	C9: .03 μF Mylar	8

This completes the wiring. Check all the wiring for proper solder connections. Make sure that all the capacitors have been connected to the proper switch lugs and do not short to any adjacent lugs. Shake out any loose wire clippings.

( ) Refer to Pictorial 2 and install a #6 Speed Nut at bracket F. Position the flat side of the Speed Nut toward the outside of the bracket.

( ) Similarly, install a #6 Speed Nut at bracket G. Position the flat side out as before.



PICTORIAL 3

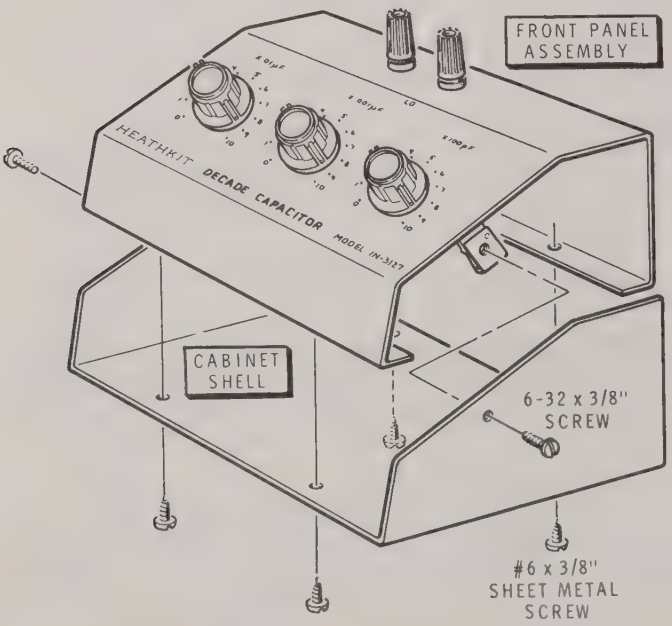
Refer to Pictorial 3 for the following steps.

( ) Position the cabinet shell as shown.

( ) Remove the backing paper from one of the rubber feet and apply the foot to the bottom of the cabinet shell at one of the four indicated locations.

( ) Similarly, install the three remaining rubber feet at the remaining cabinet shell locations.

( ) Remove the backing paper from the blue and white label and apply the label onto the bottom of the cabinet shell as shown. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



PICTORIAL 4

Refer to Pictorial 4 for the following step.

( ) Mount the cabinet shell to the front panel assembly with two 6-32 × 3/8" screws, and four #6 × 3/8" sheet metal screws. Insert the two 6-32 × 3/8" screws through the cabinet shell and into the L brackets. Install the four #6 × 3/8" sheet metal screws through the bottom of the cabinet shell into the bottom of the front panel.

This completes the "Step-by-Step Assembly" of your kit. Proceed to "Operation."

OPERATION

The Decade Capacitance Kit is very easy to operate. Simply connect it to the circuit under test and adjust the range switches for the particular capacitance needed. The total value of capacitance is found by adding the settings of the three range switches. For example; if the X .01 μF range switch is set at 8 and the X .001 μF range switch at 2, with the 100 pF range switch at 0, the total capacitance presented at the binding posts will be .082 μF. You should keep in mind that approximately 13 pF is always present at the binding posts and must be added whenever it represents a significant portion of the total capacitance involved. In applications where this might be important, make sure the black binding post is connected to the lower impedance point of the circuit under test. It is not advisable to connect the red binding post to the lower impedance point because of the variation of stray capacitance that can exist at the binding posts. Regardless of the application, make sure you observe the voltage limitations listed in the "Specifications."

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections or soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure they are soldered properly.

3. Check the values of the component parts. Make sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends, other bits of foreign matter which may be lodged in the wiring.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

SPECIFICATIONS

Range	100 pF to 0.111 μF in 100 pF increments.
Voltage Rating	400 volts DC.
Dielectric	100 pF to 1000 pF mica, 1000 pF to 10,000 pF polystyrene, .01 μF to .1 μF mylar.
Accuracy	100 pF to 1000 pF, 1%. 1000 pF to 10,000 pF, 1%. .01 μF to .1 μF, 5%.
Stray Capacitance	10 to 15 pF at terminals.
Dimensions	7-1/8" wide × 4" high × 5" deep. (18.1 × 10.2 × 12.7 cm).
Net Weight	1-3/4 lbs. (.79 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

The circuit incorporates three convenient range switches to select any capacitance from 100 pF to 0.111 μF in 100 pF increments. The capacitors that are used have a very low dissipation factor and internal resistance. As you rotate a range switch, it automatically selects one of, or a combination of, four capacitors. This capacity is then presented to the binding posts. The four capacitors of each switch are appropriately paralleled to complete the upper range of the switch.

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

Replacement parts are maintained specifically to repair Heath products. Parts sales for other reasons will be declined.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance, you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

Schlumberger

HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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